SAND LINANTHUS
Linanthus arenicola (Jones) Jeps. & Bail.

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Management Status: Federal: None
California: S2.2, G2 (CDFG, 1998)
CNPS: List 2, RED code 1-2-1 (Skinner and Pavlik, 1994)

General Distribution:

Sand linanthus occurs on the Mojave Desert of California and southern Nevada. In Nevada, it is reported to be widespread in Clark, Esmeralda, and Nye Counties (Mozingo and Williams, 1980; Kartesz, 1987; Beatley, 1976), and extends north to Churchill County (Kartesz, 1987). In California, populations occur from the vicinity of Giant Rock, north of Yucca Valley (pers. obs.) to Ubehebe Crater at the northern end of Death Valley National Park (DeDecker, 1984), and east to the Nevada state line. The species is not reported to occur in Arizona (Lehr, 1978).

Distribution in the West Mojave Planning Area:

Sand linanthus occurs widely on dunes and other sandy substrates of valley floors in the eastern and northern parts of the WMPA. It is widespread in the southern, central, northern, and eastern Mojave Desert, but is apparently unrecorded southwest of a line drawn from Lucerne Valley to Barstow and then Inyokern. Populations are known from Barstow; Pisgah Crater; Cronese Valley; Pipes Wash near Giant Rock; Twentynine Palms Marine Corps Air-Ground Combat Center (MCAGCC); near Ridgecrest; Searles Valley; and Poison Canyon, south of Trona.

Natural History:

Sand linanthus is an inconspicuous annual member of the phlox family (Polemoniaceae) which occurs exclusively on dunes and other sandy substrates. Both the plant itself and the flowers are small and inconspicuous and hence the species is seldom observed or collected. Many writers have commented on its inconspicuous character and the fact that its distribution is poorly known (Beatley, 1976; Mozingo and Williams, 1980; Peterson, 1984; Kartesz, 1987). Plants are commonly only 0.4-1.2 in. (1-3 cm) tall, but are reported to reach 3.2 in.(8 cm; Patteson, 1993).

Sand linanthus is a spring-flowering annual that germinates in the fall or winter after the onset of the winter rains. Flowering is reported to occur from March to April (Munz, 1959) and, based on specimens at UCR, this appears to be correct. The plants have an elongate slender taproot that doubtless permits the plants to secure moisture supplies below the surface layers that are quickly dried by the wind and low atmospheric humidity characteristic of its desert environment. Based on UCR specimens, it appears that the roots are typically much longer than the stems. The roots appear never to spread laterally through the soil, but rather to be directed downward almost exclusively.

The plant is characterized (Munz, 1959; Patterson, 1993) by its combination of an annual habit, presence of a conspicuous hyaline margin of the sepals that partially fills the sinuses between calyx lobes and forms a "pseudotube", the short <0.02 in. (<5 mm) pedicels, short calyx 0.016-0.02 in. (4-5 mm) and the stamens inserted deep in the corolla throat. In addition, the pale yellowish flowers with a purple throat are helpful, though these colors are shared by a few similar species. The exact flower color is open to question as the descriptions are probably based on dried specimens and few, if any, collectors have recorded the color of fresh flowers. The corolla is short and does not have a greatly expanded limb. The foliage is often described as glabrous, but in reality it is sparsely puberulent and somewhat ciliate on leaf margins near the base.

Pollinators, germination requirements, seed longevity, and most other aspects of the biology of this species are unknown. It is probably insect pollinated, unless the plant is autogamous or otherwise self pollinating as the small size of the flowers could suggest. There apparently have been no specific studies of pollination in this species, but some *Linanthus* with small inconspicuous flowers are autogamous (Grant and Grant, 1965) which may also be the case in sand linanthus. It is known that the flowers are open in the evening rather than during the day (Patterson, 1993), which suggests moth pollination is a possibility.

Habitat Requirements:

Sand linanthus is a species of well-aerated sandy soils on the valley floors, particularly near high mountains and along the courses of the larger desert rivers and washes, such as the Mojave River and Pipes Wash, where abundant fine-grained alluvium is being deposited. It is probable that it's distribution is distinctly scattered, because the sandy patches it prefers are not generally continuous, but rather are irregular in their distribution. The plant is commonly not reported in floras of upland areas (e.g., Stone and Sumida, 1983; Prigge, 1975) but is regularly found in areas that include valley bottoms with blow sand. Munz (1974) and Patterson (1993) report the elevation range of sand linanthus as 2500-4000 ft. (762-1220 m) and 800-1400 m (2600-4600 ft.) respectively. However, recent observations in the Silurian Valley have revealed many sand linanthus populations below 2500 ft. (760 m), including at least ten sites below 1000 ft. (300 m) and with one at only 395 ft. (M. Bagley, pers. comm.). In addition, the species has been reported at elevations up to 4900 ft. (1500 m) in Nevada (Cochrane 1979, Holland and Schramm 1979). The currently known elevation range for sand linanthus is thus 395-4900 ft. (121-1500 m), but most populations appear to be between 1000 and 3500 ft. (300-1050 m). However, it appears that the most important environmental characteristic directly controlling the distribution of sand linanthus is the presence of a loose sand substrate. It is probable that the species is controlled by elevation only indirectly. At higher, and thus moister, elevations the greater vegetation cover effectively controls the presence of significant deposits of loose sand and eliminates any habitat for this species. Drier sites, especially those near a significant sand source, are probably preferred by this species.

Sand linanthus occurs in loose wind blown sands or loose sandy to fine gravelly soils, on dunes, alluvial slopes, valley flats, or along washes. Munz (1974), Patterson (1993) and Kartesz (1987) all report this species on gypsum rich soils, but this is certainly

not a requirement of the species. In fact, I have never observed it on gypsum soils. Bagley (pers. comm.) likewise has not observed it on gypsum at sites in Eureka Valley, Indian Wells Valley, Wingate Pass, Cronese Valley, Soda Mountains, and Silurian Valley. Sites occupied by sand linanthus typically have only relatively gentle slopes; it does not occur on steep hillsides or high-gradient alluvial fans. It is probable that it does not occur on steeper slopes because the higher energy erosional environment there prevents the extensive deposition of the fine-grained materials it prefers.

Sand linanthus occurs almost entirely within the creosote bush community as defined by Munz (1959; 1974), but has also been reported in desert sink scrub (CDFG 1997b) and desert saltbush scrub (CDFG 1997b). Munz (1974; Munz, 1959) also reported this species in Joshua tree woodland, but this appears to be only marginally so. The plants on the Sand Hill training range of the Twentynine Palms MCAGCC are in an area with a sparse stand of Joshua trees (pers. obs; pers. comm., M. Elvin).

Population Status:

Populations of sand linanthus are almost completely unstudied, but are probably reasonably stable. Plants are not usually common, but rather are present as scattered individuals. About 200 plants were recorded in about one hour in Cronese Valley (pers. obs., 1978) but otherwise the plants are generally recorded as infrequent or scarce. Some populations have doubtless been lost to highway construction, urbanization, and other human activities within its habitat, but this cannot be conclusively shown. There appears to be no reason to believe that this species has suffered significant declines in population size.

A convincing case cannot be made at present that this species is rare, though it is certainly not a common species. It appears that this is a plant that has never been much more common than it is today. It has a moderately specialized habitat and for some reason seems not to form large populations, even within this preferred habitat.

Threats Analysis:

Threats to sand linanthus are difficult to define, but doubtless include off-highway vehicles, which heavily use some of the dunes occupied by this species. Some populations have probably been lost or reduced by urbanization, highway construction and other similar activities, but the extent of this cannot be documented.

Biological Standards:

There is a crucial need for surveys to test the hypothesis presented here, that this species is not currently rare enough to require special protection measures. My prediction is that as additional areas of suitable habitat within the species' known range are surveyed, additional populations will be found. In addition, I predict that if sites of know population are surveyed it will be found that populations are more extensive than is presently known. If my hypothesis is wrong, then it will be difficult or impossible to find additional populations and the known populations will be found to be small and restricted in area.

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